Physical Sciences Seminar

Quantum physics in one dimension using Josephson junction arrays

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Quantum physics in one spatial dimension is peculiar and remarkably rich, yet even with strong interactions and disorder, surprisingly tractable. This is due to the fact that the low-energy physics of nearly all 1D systems can be cast in terms of the Luttinger liquid, a key concept that parallels that of the Fermi liquid in higher dimensions. Although there have been many theoretical proposals to use linear chains and ladders of Josephson junctions to create novel quantum phases and innovative electronic devices, only modest progress has been made experimentally. One major roadblock has been a lack of understanding the role of disorder in such systems. We present recent experimental results that strongly confirm TLL behaviour in our devices, validate the quantum many-body theory of one-dimensional disordered systems, and shed light on the competition between Mott insulator and Bose glass. The Bose glass phase is thought to describe helium-4 in porous media, cold atoms in disordered optical potentials, disordered magnetic insulators, and thin superconducting films. The ubiquity of such an electronic glass in Josephson-junction chains has important implications for their proposed use as a fundamental current standard, which is based on synchronisation of coherent tunnelling of flux quanta (quantum phase slips). Recent extensions of this work to SQUID chains and ladders will also be presented.

Friday, February 16, 2018 11:00am - 12:30pm
Big Seminar room Ground floor / Office Bldg West (I21.EG.101)

This invitation is valid as a ticket for the ISTA Shuttle from and to Heiligenstadt Station. Please find a schedule of the ISTA Shuttle on our webpage: https://ista.ac.at/en/campus/how-to-get-here/ The ISTA Shuttle bus is marked ISTA Shuttle (#142) and has the Institute Logo printed on the side.